

Complex zircon morphologies and Zr-Hf mobilization produced by partial melting of metabasalts in the Sudbury Igneous Complex contact aureole

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Poikilitic zircon forms complex interstitial networks with low dihedral angles along grain contacts of silicates and oxides interpreted to represent the peak metamorphic mineral assemblage in two-pyroxene hornfels metabasalts in the proximal part of southern contact aureole of the impact generated 1850 Ma Sudbury Igneous Complex (SIC). Similar zircon morphologies have been previously described only in lunar meteorites. The zircon grains are commonly 10-25 μm and characterized by the local presence of sector zoning, or an otherwise simple internal texture with no evidence for shock metamorphic features, significant metamictization, or different age domains. Phases present in hydrothermally re-equilibrated zircons (e.g., thorite, coffinite, and thortveitite) are never present as inclusions. In-situ U-Pb geochronology yields an age of 1850 ± 24 Ma for the zircons, which are characterized by relatively low Ti contents (avg. 5.2 ± 0.8 ppm) and high Yb contents (ca. 30-330 ppm). Collectively, these observations are consistent with zircon crystallizing from trapped melt films in the high temperature part of the SIC contact aureole. This interpretation is supported by the absence of similar zircon textures in equivalent metabasalts further from the SIC contact. The poikilitic zircon textures are observed only in metabasalts exhibiting strong negative whole-rock Zr-Hf anomalies and sub-chondritic Zr/Hf ratios, indicating that Zr and Hf were mobile during contact metamorphic processes. Zr anomalies (expressed as Zr/Zr^*) extend up to 250 m away from the SIC. The presence of local leucocratic quartz-plagioclase melt patches in the two-pyroxene hornfels metabasalts indicate that silicate melt was the mobilizing liquid phase, and that melt-escape was an important process within the southern proximal contact aureole of the SIC.